MECHANIZATION AND AUTOMATION

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UPGRADE OF ELECTRIC WEIGHING CARS

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Aspects of upgrade and development of electric weighing cars for preparation of glass batches and multicomponent mixtures in the production of refractories and ceramics are considered.

Electric weighing cars are used in batch preparation to prepare small volumes of glass batch (50 – 100 ton/day) and obtain multicomponent mixtures in the production of refractories and various types of ceramics.

An electric weighing car in a general case is a travelling multicomponent weigher consisting of a carriage with wheels and an electric motor drive, a receiving hopper with a discharge gate, an operator workplace with the start-up-and-control equipment, and a weighing system. Many weighing cars are equipped with platform scales or beam balances with dials, which do not ensure the required accuracy of weighing batch materials, and the operator has to manually control the weighing process.

Stromizmetritel' JSC is active in upgrading existing cars and developing new weighing cars controlled semi-automatically or automatically.

Upgrade of electric weighing cars (Fig. 1) involves replacement of the beam balance by strain-gage weighing supports and installation of a digital indication block on the operator's workplace. The indication block measures analog signals coming from the strain-gage transducer on the weight-receiving device and converts these signals into numerical values proportional to the weight of the material proportioned. All data on component weighing are shown on a digital display that is functionally split into two groups. The first group consisting of two indicators records the number of the hopper, from which material is fed into the car, and the second one contains five current weight indicators and operates in four modes. In addition to showing current weight (the main mode), the display indicates the dose for each component, the schedule of weight increment and cessation of material feeding, the weights of containers and calibrating weights in conventional units of the digital-analog converter, as well as an arbitrary sequential number of a failure arising in proportioning.

The schedules and parameters of weighing are set by the operator on a keyboard located on the front panel of the indication block.

Technical characteristics of strain-gage weighing car of 500 kg load-carrying capacity

Capacity of weight-receiving hopper, m^3	0.46
Discharge gate of the hopper	Hand-operated sector gate
Velocity, m/min	26
Weighing limit, kg:	
minimum	40
maximum	500
Weighing error within the prescribed interval, kg	0.36
Supply voltage, V	380 ± 10
Type of strain-gage transducers	Bar type, 4 × 1000 kg
Rut width, mm	740
Overall sizes, mm:	
length	2186
width	1052
height	1300
Mass, kg	855
Ambient temperature, °C	– 30... + 30

It is possible to make strain-gage electric weighing cars of load capacity up to 1500 kg for any standard rut size equipped with modified digital indication blocks, which make it possible to save and store technological parameters (time and date of weighing, hopper number, weight and consumption of materials proportioned, weighing errors, etc.) and subsequently transmit these data via an Ethernet interface into a personal computer, which can be installed, for instance, in the technologist's or in the division head's office.

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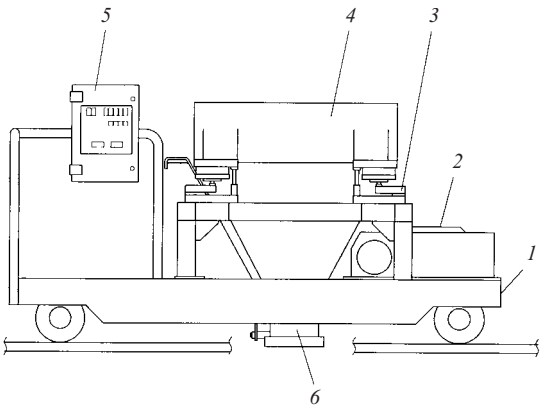

Fig. 1. Strain-gage weighing car: *1*) carrier frame; *2*) car drive; *3*) strain-gage support; *4*) weighing hopper; *5*) indication block; *6*) discharge gate.

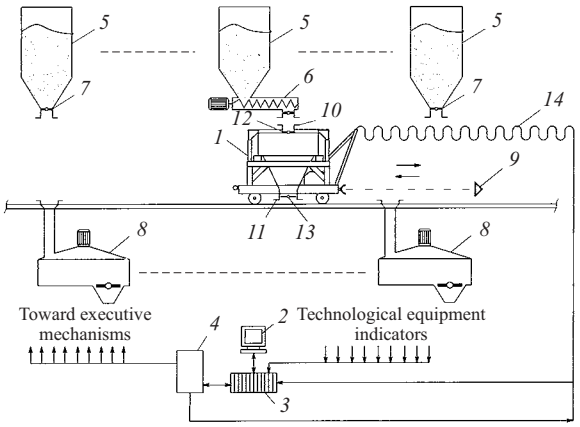

Fig. 2. Line for preparing multicomponent mixtures.

Upgraded electric weighing cars with strain-gage weighing transducers and digital indication blocks are employed at the Medsteklo Company (Klin), Krasnyi Oktyabr' Glass Works (Vladimir Region), and some other glass industry enterprises.

Stromizmeritel' JSC is currently completing the development of a fully automated production line for multicomponent mixtures, which differs from the previous line (USSR Inventor's Certif. No. 1649504) in a new design of the strain-gage electron weighing car and wider functional possibilities. The production line (Fig. 2) operates as follows. A strain-gage weighing car *1*, which is controlled by means of a control system consisting of a personal computer *2*, a microprocessor controller *7*, and a panel *4* with start-up instruments, according to a preset algorithm, moves on rails along a series of service hoppers *5* equipped with screw *6* and gravity *7* feeders. Positioning of the car in programmed motion from one hopper to another and then to the place of discharge of materials into a mixer *8* occurs in two stages. In the first fast-motion stage, the count module of the microprocessor controller, following a signal from the pulse sensor that is mechanically connected with the car wheel, determines the required transport distance and issues a command to switch off the car drive. In the second stage, the exact position of the car is measured using a laser distance finder *9* and a command is issued for slow motion and precise stop in front of a corresponding hopper. The smoothness of speed-up, deceleration, and velocity control of the weighing car are achieved by means of a frequency converter controlled by the microprocessor controller.

In order to avoid overspilling and dusting of material in the course of charging using screw and gravity feeders and in discharging into mixers, the car has a charge *10* and discharge *11* coupling units and sector gates *12* and *13*. The coupling units are switched on according to a program after precise positioning is completed. Having received a preset portion of a certain material according to the batch formula, the car is automatically transported toward the next service hopper or to the site of feeding materials into the mixer.

The number of service hoppers can vary from 2 to 21 and the number of mixers from 1 to 9, depending on the formula of a multicomponent mixture. The link between tyhe executive mechanism and the control-and-measuring instruments of the car with the control system is implemented by cable tail connection *14*, which keeps moving along the service hoppers during motion of the weighing car using special carriages and a guiding structure.

The motion of the car and the whole process of preparation of a multicomponent mixture is monitored on a display using a mnemonic scheme; moreover, the batch formula can be set and corrected via the PC keyboard. All results of the line performance and all daily and emergency events are recorded and stored in the control system database and can be printed out for a particular period of operation.